

**Notes on the Life History of *Notonecta hoffmanni***  
(Hemiptera : Notonectidae)

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The backswimmer, *Notonecta hoffmanni* Hungerford, is a common inhabitant of freshwater ponds and streams in its known range. It has a limited distribution, being found only in Arizona, southern California, Baja California, Mexico (Hungerford, 1925) and New Mexico (Sailer, 1942). The male and female adults were originally described by H. B. Hungerford in 1925 and up to the present time no further work has been done on the taxonomy or biology of this species.

The purpose of this investigation was to determine the life history of *N. hoffmanni* with special attention given to the length of the life cycle and feeding habits.

The investigation was conducted in a 150-foot-long section of Viejas Creek located 3½ miles east of Alpine, San Diego County, California at an elevation of 2,230 feet above sea level. This creek is one of the few streams in San Diego County which runs the entire year. It originates in drainage from Chiquito Peak, the Viejas and Poser mountains which are to the north and from mountains in the Cleveland National Forest which are to the south, becoming a permanent flowing stream in the Viejas Indian Reservation. It winds through the hills for only a few miles and then joins the Sweetwater River approximately 1 mile north of the eastern end of the Loveland Reservoir.

#### MATERIALS AND METHODS

The field observations were begun in late August of 1963 and continued through August 1964. With the approach of the reproductive period in late winter, weekly observations were begun. Water temperatures were recorded as well as dates of copulation, oviposition, stages of egg development (browning and eyespot appearance), and the emergence of the different instars. All notes were taken in the late morning and early afternoon hours.

The fact that adults were present from the previous year made detection of the newly emerged individuals difficult. The problem was solved by screening off an outpocketing of the stream, approximately 3 feet by 3 feet, removing all stages present and replacing these with fifth-instar nymphs.

In addition, notes were taken on the number of developmental stages

and the feeding habits in the laboratory as well as in the natural environment. Oviposition, hatching, and molting were observed in the laboratory.

#### LIFE HISTORY

In the early part of March, copulation and oviposition were observed in the stream. The water temperature varied between 14° and 18° C during this period. Copulation takes place with the male in a dorsolateral position to the female; the latter does the swimming for the pair.

Eggs are laid in irregular rows on the stems of vegetation beneath the water surface. They were first found in the easternmost part of the study area on stems of *Vinca major* L., a garden escape. This was the section from which most of the observations were taken. In subsequent days, I found them on stems of *Juncus acutus* L. var. *sphaerocarpus* Englm. and *Heleocharis* sp.

Oviposition begins with a series of dorsoventral undulations of the posterior third of the abdomen; these movements cease as the egg appears. The female rests quietly for a few seconds after attaching the egg to a substrate. The egg laying takes about 1½ minutes.

Fresh eggs are white but darken as they mature. Following this, the eyespots begin to appear, and just before hatching they are well developed. Large hairs of the nymph are visible through the chorion at this time.

Hatching occurs with the formation of a dorsoventral slit at the cephalic (widest) end of the egg. Rhythmic movements of the head are noticeable at this time. Body contractions are evident as the nymph emerges through the ventral side of the cephalic end in a jerky manner. The nymph is surrounded by an embryonic (vitelline) membrane which is visible as it emerges from the egg. The nymph subsequently frees itself from this membrane, with the metathoracic legs being the last to leave the egg.

In the middle of April, I first noticed the darkening of the eggs but was unable to detect eyespots until the first of May. On this day I found a newly emerged nymph. It was very light in color and was swimming beneath the surface near the shore among the stems of *Heleocharis* sp. Molting takes place by the emergence of the later instar through a longitudinal slit in the dorsum of the earlier instar.

On 21 May I found a second nymphal instar near the shore but not as close to the vegetation as the previous instar. The water temperature was 22.5° C. On 8 June I observed a third nymphal instar in the deeper part of the pool swimming among the adults. The water temperature was

15° C at this time. Later in the week the relative numbers of first, second, and third nymphal instars were approximately equal.

During the following week, the fourth nymphal instars began to appear. First and second nymphal instars were still present in small numbers. The water temperature was 16° C. On 26 June I found adults of different species of backswimmer, *Notonecta kirbyi* Hungerford, which had probably migrated into the area. The water temperature was 20.8° C on this day. On 6 July I observed the first fifth nymphal instars in the area. The water temperature had risen to 21.2° C.

Two weeks later, the fifth nymphal instars were the most abundant of the immature stages. Three first nymphal instars were collected as well as older stages. Few specimens of *N. kirbyi* were collected. On 29 July a newly emerged adult was collected. The water temperature was 18.9° C at this time.

During August, the number of adults of *N. hoffmanni* increased; at least some of these will remain in the area to begin the reproductive cycle again in March of the following year. The population size at this time was estimated to be 307 individuals by using the Lincoln Index method. Specimens had been successfully marked with colored fingernail polish. At the end of summer, it was no longer possible to collect adults of *N. kirbyi*.

#### FEEDING HABITS

*N. hoffmanni* normally feeds on insects which fall to the surface of the water; these are abundant in the spring and appear to be adequate to sustain all stages of the species. I have found them feeding on Hymenoptera, mainly ants, Diptera, and Hemiptera, especially mirids, which had fallen from the overhanging branches or had been blown into the water by the wind. Clark (1928) reported that *Notonecta undulata* Say was attracted to its prey by sight and by vibrations due to the hapless insect's movements on the surface of the water. This is probably true of *N. hoffmanni*. It grabs the prey with the prothoracic and mesothoracic legs and then inserts its proboscis as the animal is dragged beneath the water surface. It does not return to the surface until the prey has ceased struggling.

#### SUMMARY

It was found that at Viejas Creek, the life cycle of *Notonecta hoffmanni* began in the early part of March with copulation and oviposition occurring simultaneously. Eggs were found on the submerged parts of stems of *Vinca major*, *Helocharis* sp., and *Juncus acutus* var. *sphaerocarpus*.

A first nymphal instar was captured on the first of May followed by the first noted appearances of the second, third, fourth, and fifth nymphal instars and the adults on 21 May, 8 June, 18 June, 6 July, and 29 July, respectively. *N. hoffmanni* normally feeds on insects which fall from the overhanging branches or are blown into the water by the wind.

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#### RECENT LITERATURE

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